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LABOUR IN THE TROPICS.

TROPICAL development is now a generally accepted policy of Governments with colonial possessions; the encouragement and improvement of commercial crops is undertaken by the agricultural departments, transport and agricultural credit facilities are provided officially, help is often given by means of tariff devices and in many other ways economic progress is simplified. Attention might well be given to labour studies as the ultimate analysis of the cost of most articles for final consumption would show the importance of this factor. The study of population and its growth is obviously the first thing to be considered and on this there is a good deal of information. Writers on population in the early nineteenth century, influenced by contemporary events, and, in England particularly, by the depressed condition of the labouring classes, considered that population tended to grow to the limit of food resources and that any increase of the latter would be accompanied by an increase in population. At present, however, this does not hold with the industrial communities of developed countries. Opportunity, education, and foresight have caused the increase in prosperity which has resulted from economic progress in the nineteenth century to be devoted to the improvement of their standard of life. In the tropics, early marriage and the lower standard of life tend to make increase in population larger than in temperate climates and it would seem that the available supply of the necessities of life sets the upper limit. In India, although the standard of life has been gradually improved by the provision of public works, improved medical and sanitation methods, irrigation canals and the encouragement and of exchangeable crops, the chief effect of the improvements has been to lead to a greater rate of increase of population. Another effect has been a diminution in the intensity and length of work; enough is earned in a shorter time to provide the elemental necessities of life and the rest of the time is idled away. Of more importance than possible supply is available supply and this depends on the population and its willingness to work at places where developments are taking place. Many important producing centres in the tropics have been starved of labour and the provision of adequate supplies has been an important part in their development. The pioneers in the new world development were aware that natives of Africa were habituated to slavery and started that westward migration

which provided labour for the plantations of the West Indies and the mines of Central America. The institution of slavery is as old as the world, but the evils of the slave raiding and the horrors of the middle passage, were special features of the commercial slave trade. Happily plantation slavery and the slave trade were abolished long ago, although, as we were recently reminded by the wave of indignation that swept through the press on occasion of the decisions with regard to the return of runaway slaves in Sierra Leone, slavery in Africa is not yet quite dead. This domestic slavery is a very different thing from plantation slavery, and, in some cases where the alternative of freedom has been offered, slaves have preferred to maintain their status. The institution is not encouraged and in many parts has been wiped out gradually by well conceived ordinances. From the economic point of view, slaves are often regarded as wasteful; their first cost and cost of replacement is high, high charges have to be incurred in their supervision, and the lack of incentive to work makes them less efficient than free labour. After their schooling to bondage, slaves took a long vacation and although the well kept plantations did not immediately suffer from the absence of labour, the want was not long in being felt. Schemes were then devised for the importation of workers from places where the population was redundant, usually the East. To prevent the evolution of a new slavery under another name, elaborate rules were drawn up for their protection. The labourer is usually party to a contract and "contract labour" as it is called, is now generally recommended as the best form of providing labour for places where it is inadequate. Where population is large enough to supply labour needs, but where the people are unwilling to work, various devices are adopted. One very usual one being the imposition of a tax, the necessity for the payment which impels the native to do some work. Formerly, and even at present by some governments, compulsion is used. Experienced tropical administrations have said, however, that such a system is likely to be pernicious in its effects. Immigrant workers under the contract system have done well for themselves and their second countries. The Indians in the West Indies, Mauritius and other places, and the Chinese in Malay are not only responsible for the continued economic development of these places, but they have risen beyond the position of their own class in their home country. This has often been due to the salutary effect of regular hours and continuous work. A few days work would satisfy the needs of their former standard of life but the continuous work enforced by their contract left them with a surplus, often partly devoted to an increase in their standard of life.

The labour value of a population depends not only on its supply but on its quality, and several interacting causes influence this—race, climate, and social institutions all have their effects. The races inhabiting the tropics are numerous and varied, and, in general, indolence, lack of foresight, and ignorance are attributed to them. How far these attributes are racial it is difficult to see, to a large extent they must be ascribed to an enervating climate and to the prevalence of debilitating tropical diseases. However, the fact still remains that compared with the standard of effort in temperate countries, the efficiency of tropical labour is low. A subsidiary climatic effect is the influence of seasons on effort; in several parts, enforced idleness due to climatic conditions adverse to cultural operations contributes to make the people less energetic. Institutional influences, such as those of religion, education and customs vary greatly. In certain parts of Africa, the men have been unused to peaceful agricultural work and are an adverse factor on agricultural progress; amongst the Chinese coolies of Malay the secret societies are a disturbing element. In India, religious obligations to cattle do not permit of their full use for agricultural purpose; the system whereby members of a family share alike its fortunes and ills puts a premium on idleness; the system of fragmentation of holdings is not conducive to agricultural progress, and the caste system, although not so rigid as one might think, is an obstacle to individual and national progress which is absent in temperate climates. Again, in the islands of the South Pacific, the communal and shifting system of cultivation tends towards the growing of only the absolutely necessary supplies of foodstuffs, and, their elemental needs being satisfied, the people cannot be persuaded to use further efforts in the cultivation of commercial crops.

In discussing efficiency we may speak of real and nominal efficiency. Nominal efficiency is usually secured by the outside employer but the real efficiency of the labourer often comes out when he is working for himself and when the difference is greatly in favour of the latter, the encouragement of peasant proprietorship is obviously the line to be taken up from the point of view of the administrator. The relation between wages and efficiency is worth attention, in temperate climates a rise in wages is sometimes accompanied by a rise in efficiency, but in the tropics is usually followed by a diminution in the intensity and period of work because the same wants can be satisfied with less effort. Obviously an increase in these wants by the encouragement of a higher standard of life would seem desirable and this would be likely to follow from an educational system conceived on sensible lines.

It would seem that with the present distribution of population, a good deal could be done to improve its quality by means that are not objectionable, and, if some redistribution of tropical peoples could be carried out both to the satisfaction of the supplying and demanding countries and the humanitarian section of the world's population, many of the labour troubles of the tropics could be alleviated.

Weevil-Borer of Cane

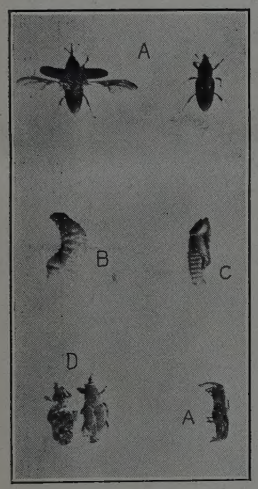
Box of Canes containing *Puparia* of the *Tachinid fly parasite* of the *Weevil-Borer* established in infested canefield.

Larva of *Weevil-Borer* (magnified).

Tachinid Fly Parasite (*Ceromasia sphenophori*) (magnified).

Tachinid Flies killed by *Empusa fungus* (nat. size).

Weevil-Borer of Cane



A. *Weevil-Borer* of Cane.
B. *Larva* of same.
C. *Pupa* of same.
D. *Weevils* attacked by "Green Muscardine fungus" (all spms. nat. size.)

Longitudinal sections through Borer-infested cane-sticks; showing nature of internal damage; with a borer-grub and cocoons lying in tunnels (natural size.)

Cage used for breeding Tachinid Fly Parasites.

WEEVIL BORER OF CANE.

How to breed the Tachinid Parasite of the "Weevil Borer" of Sugar-Cane.

BY EDMUND JARVIS.
Entomologist in charge of the Bureau of Sugar Experiment Stations. Inspector under Diseases in Plant Act, &c.

CERTAIN species of dipterous parasites cannot be successfully propagated unless care be taken to provide them with artificial surroundings, practically similar to those enjoyed under natural conditions.

The size of a large Breeding-cage depends very much of course upon the species to be reared, and may easily vary from 50 to 400 cubic feet; the space afforded by the latter, however, allowing in most cases ample room for artificial establishment of environmental conditions of a nature conducive to the mating and oviposition of such parasitic flies.

After many years of experimentation in connection with the rearing of *Ceromasia sphenophori* the writer is in a position to make known several valuable hints relative to the breeding of this useful parasite, which will doubtless be of much interest to economic entomologists in other sugar-growing countries.

CONSTRUCTION, SIZE, AND POSITION OF THE CAGE.

Our largest cage used for breeding this Tachinid fly at Meringa Experiment Station measures 8ft. 6ins. by 8ft., with a height of 7ft. 6ins. from floor to ceiling; thus giving a capacity of about 400 cubic feet of space. The timber needed for the framework of a cage of this size should be of hardwood, and of the following scantlings:—

4 Corner Posts	.. ..	10 ft. 2 in. long by	4 in. by 4 in.
2 Floor Plates	.. ..	7 ft. 9 in. do.	4 in. by 2 in.
4 Floor Joists	.. ..	9 ft. do.	4 in. by 2 in.
4 Studs	.. ..	8 ft. 8 in. do.	3 in. by 2 in.
2 Braces	.. ..	10 ft. do.	1 in. by $1\frac{1}{2}$ in.
2 Wall Plates	.. ..	7 ft. 9 in. do.	$1\frac{3}{4}$ in. by $2\frac{3}{4}$ in.
4 Ceiling Joists	.. ..	8 ft. 7 in. do.	$1\frac{3}{4}$ in. by $2\frac{3}{4}$ in.
9 Floor Boards	.. ..	7 ft. 2 in. do.	12 in. by $1\frac{1}{2}$ in.
7 Dado Boards	.. ..	8 ft. 6 in. do.	9 in. by 1 in.
Woodwork for Door	.. ..	9 ft. of $2\frac{1}{2}$ in. by $1\frac{1}{2}$ in.	
Hood, screening Door	.. ..	8 ft. of 2 in. by 1 in. and 2 ft. 4 in. of $2\frac{1}{2}$ by $1\frac{1}{4}$ in.	
Door Stops	.. ..	3 ft. length of 1 in. by 1 in. and 3 ft. length of 1 in. by 3 in.	
Fillets	.. ..	190 ft. run of $\frac{1}{2}$ in. by $\frac{1}{2}$ in.	
Hinges for Door	.. ..	2 pairs of Butt (8 screws) $2\frac{3}{4}$ by $3\frac{3}{4}$ in.	
Iron Bolts	.. ..	8 of 6 in. by $\frac{3}{4}$ in. 8 of $4\frac{1}{2}$ by $\frac{1}{4}$ in. 4 of 6 in. by $\frac{3}{4}$ in.	

COVERING THE FRAMEWORK OF CAGE.

The top should be of strong calico, well washed before fixing in order to shrink it and get rid of dressing, which otherwise would be carried into the cage by rain and contaminate the water supply. One side of the cage should also be of calico, similarly treated, and all mosquito netting used for the other sides should first be well rinsed in cold water to shrink it and get out the stiffening. Use only netting of good quality and small mesh, as this will last for nearly two years before renewing.

Make the sides of hood surrounding the door of calico, and the roof of netting, as a top light will tend to attract any flies that may escape during opening of the door, thus facilitating their capture from below. Cover the joints between floor boards by strips of wire gauze, fillets, or sacking tacked to the boards.

If employing sacking for this purpose see that it be quite clean (not cut from sacks previously used for chemical or organic manures, &c.). The legs of the cage should be stood in galvanised iron pans containing water, of size 15 ins. by 15 ins. by 7 ins. deep, resting upon square plates of wood about one inch thick.

When fastening netting or calico let it lie just flat between the studs or posts, but do not stretch it. Use one inch brads for securing fillets covering edges of netting (after tacking latter in position), so that when the cage requires recovering these fillets can be easily prized up and used over again.

POSITION OF CAGE.

When placing the cage in position see that the calico side faces the most windy quarter; and that afternoon sunlight be obstructed either by shrubby vegetation, or by the wall of some building standing close enough to cast a shadow over the roof of the cage during most of the afternoon. One should aim at securing conditions of seclusion; free during most of the day from excessive heat, bright light, or drying winds.

STOCKING THE CAGE.

Borer grubs intended to serve as hosts for this parasite are usually cut out of badly infested cane sticks obtained from the nearest plantation.

During this work each grub should be placed separately in a small glass tube to prevent them from biting each other. In the event of supplies being difficult to procure close at hand these larvae can be propagated in a smaller secondary cage having wooden sides 2 to 3 feet high to accommodate borer-infested canes intermingled with healthy sticks.

Beetles obtained when cutting up canes, or those attracted to the outside of the big cage, should be placed in the smaller one in order that they may oviposit in the healthy sticks.

This intermixed mass of canes are not planted but kept moist by being covered over with sacks which are regularly wetted at intervals to maintain damp darkened conditions favourable to the breeding of this weevil-borer.

Use "Badila" canes, or some such thick juicy variety as a food supply for grubs put into the cage containing the Tachinids.

To prepare these, cut the roots from basal portion of the canes, and wash off soil to remove ants, &c. Then, with a sharp cork-punch of about $\frac{1}{4}$ inch diameter make holes from $\frac{3}{8}$ to $\frac{7}{8}$ of an inch deep at centre of each internode, starting 9 inches from basal end and finishing about 12 inches from the top of a stick. After making a hole put into it, head first, a borer grub, which will at once wriggle down out of sight. Then cover the top of the hole with a wad consisting of the interlaced woody fibre used by the larva of this weevil for constructing its cocoon. This wad must on no account be compressed or tightly fitting, but should be loose enough for the tiny maggots of the parasite to crawl amongst the fibres and reach their host. As a matter of fact the only purpose served by these plugs is to keep the borer grubs from falling out of the holes while such loaded canes are being installed in the breeding-cage.

The old cumbrous method of filling the bottom of a cage with a layer of soil in which to plant the artificially infected sticks proved unsatisfactory in many ways, and the writer found it best to plant these canes in small tins of soil (a kerosene tin with one side cut out answers the purpose). Each tin will hold from 12 to 15 sticks, planted 8 inches deep; and several $\frac{3}{4}$ inch holes should be made in the bottom for drainage.

By adopting this method, chance invasions of ants are easily controlled, sticks can be shifted into any position desired when planning to establish shaded portions for the flies to harbour in, and damage to bottom of cage from weight of soil (30 cubic feet or more) as well as trouble arising from the close presence of such a body of earth during wet weather, is done away with.

Tins of soil in which have been planted young banana suckers from 1 to 2 feet high, cannas, or other suitable plants having broad, somewhat drooping, thick leaves to which drops of water will adhere without easily rolling off, should be placed in the cage amongst the tins of cane sticks. One clump of these plants should be in a position where early morning sunlight will fall on the leaves, and another where the plants will not be touched by sunlight during the middle of the day.

These leaves should be watered about 8 a.m., and again at 1 p.m., this being very simply accomplished by throwing over them, while standing outside the cage, about half a pint of clean rain water.

The forceable passage of this through the netting will break up the water and cause it to fall upon the leaves in the form of a coarse spray, which usually adheres well and takes some time to evaporate.

Such watering must on no account be neglected, sufficient moisture being essential to the successful breeding of this insect.

On excessively hot days, or when the air is very drying, it is advisable to give three waterings. Between the hours of 11 a.m. to 3 p.m. during the worst heat of the year (December to March in the Cairns district of Queensland) these Tachinids usually seek out the coolest spots available. To meet this need congenial resting places can be provided by standing some of the tins of moist soil containing canes side by side, about an inch apart. The flies will be found to settle in the narrow spaces left between the tins, where the atmosphere is a few degrees cooler than the outside woodwork or vegetation; the nearness of the two metal surfaces tending to maintain somewhat uniform cool, shaded, and secluded conditions.

Feed the flies once a day at 8 a.m., using for this purpose about half a dozen pieces of cane stick 12 inches long split in half lengthwise. These are laid cut side up on the soil of tins containing canes or plants, and should be renewed each morning.

Each grub-infected stick planted in the cage should have a label tied to it, giving the date and number of sticks put in on that day, together with the number of flies present in the cage at the time. Valuable data can be acquired in this way with regard to the probable percentage of puparia likely to be obtained per stick as a result of the activities of a given number of the caged parasites.

When transferring sticks from a breeding-cage for establishment in borer-infested canefields select those which have been a month or 25 days in a cage containing from 25 to 40 or more flies, as these canes will doubtless harbour numerous puparia, from which the parasites should issue about a week later.

Water must never be allowed to lie on the surface of the soil or floor of cage.

COMBATING ENEMIES OF THE PARASITE.

Under artificial conditions, the chief insect foe of *Ceromasia sphenophori* appears to be the small black ant, *Pheidole megacephala*, which in the district of Cairns happens to be a very common and troublesome species. Its attacks, however, can easily be prevented, as before mentioned, by standing the legs of the cage in water. Should an invasion occur owing to some unforeseen cause, the tin or tins of sticks found to be infested by this pest should be at once removed from the cage, the earth thrown out, and the canes replanted in

clean soil. Shift any remaining tins a foot or so along the bottom of cage to see if ants be under them. Scald the flooring and ground-plates with boiling water if necessary. Small lizards or Jumping-Spiders are sometimes inadvertently introduced into a breeding-cage. To guard against this it is advisable to remove the heart-leaves from any canes placed in the cage, by severing the latter just below the growing point. Lizards will sometimes gain an entrance from the outside, so it is well to keep a look out for them on the netting during early hours of sunlight, at which time of day they will often bask in the warmth and are not difficult to capture.

The entomogenous fungus (*Empusa sp.*) is occasionally responsible for heavy mortality amongst these Tachinids, but fortunately this occurs only during part of the wet season. Prolonged rains during midsummer greatly favour development of this fungus-parasite, and at such times mortality may continue for two or three weeks, ultimately destroying from 50 to 80 per cent. of specimens in a cage. All one can do is to remove the dead flies (found covered with mould, stuck to the leaves or sides of the cage with legs extended) and dab the spot with a solution of 20 per cent. formalin or some other strong fungicide.

FIELD LIBERATION OF TACHINID FLIES.

When collecting flies from the cage for liberation, select about an equal number of each sex; regarding the smaller and more slender specimens as being the most likely to be males.

From 25 to 30 flies constitute a good consignment, and should allow for destruction of a certain percentage by birds and insect enemies. The caged flies are easily caught in glass test-tubes, of size about 7 inches long by 1½ inches in diameter, which should be well washed inside and carefully dried before using.

If the mouth of a tube be gently placed over them they will fly into it and settle on the side. Eight to ten specimens may be caught in one tube, the mouth of which is then closed by a well fitting wad of damp cotton wool, previously rinsed and thoroughly cleansed in clean tap water. The best time to catch such dipthera is at daybreak after a cool night, when they are disinclined to fly, and should always be timed with view to securing a minimum period of captivity in the tubes.

Food is supplied during transit by a thin wafer of cane-stick cut lengthwise, about 3 inches long by ½ an inch wide, one end being held by the wad closing the mouth, which presses the wafer firmly against the side of the tube, so that flies can rest on it to feed but cannot get jammed between it and the glass.

The parasites invariably travel well in these tubes, suffering little or no mortality from a journey of two or three days, but should be kept as cool as possible. Advantage should also be taken of stoppages at hostels, &c. to ventilate the tubes.

It is advisable to carry a spare one to which flies can be transferred, should it become necessary to wipe the inside of any containing parasites. To ventilate a tube (which should be done at intervals of from six to eight hours) remove the wad and substitute a cap of perforated zinc or wire-gauze, then lay it on its side for a few minutes with mouth facing the wind.

Always replace the damp wad to keep ants from getting into the tube and killing the flies.

Upon reaching one's destination arrange if possible to liberate the parasites just after sunrise, as if let loose in the evening they will have to face several hours of inactivity, during which many specimens may fall an easy prey to ants and spiders before having had a chance to oviposit in tunnels of the borer.

The spot chosen for liberation should be in the midst of badly infested cane-sticks, and near the windward side of a plantation. Before removing the wads from tubes it is a good plan to sprinkle the leaves of a few of the cane stools near at hand with rain water.

When establishing puparia of the parasite in canefields, select three or four canes from a breeding-cage, of age described above (*see* Stocking the Cage), and place these in a light box made of softwood, about 2 ft. 6 ins. × 9 ins. × 9 ins., fixed in such manner as to keep the canes from touching each other or the sides of the box. A few transverse slits about ¼ inch wide should be left at intervals when nailing on the lid to allow the Tachinids to escape after emergence from the puparia. Four legs about a couple of feet long are attached to the ends of the box when reaching the field. These must be stood in pans of water as a protection from ants, and in addition to such precaution any cane leaves thought likely to blow against or touch the sides of the box should be removed.

EMPIRE AGRICULTURE.

FOLLOWING the recommendation of the Colonial Office Conference, the Colonial Secretary (Mr. Amery) has appointed a Committee to formulate proposals, for submission to the Colonial Governments, on Colonial Agricultural Scientific and Research Services.

The proposals should include a scheme for the creation of a Colonial Agricultural Scientific and Research Service available for the requirements of the whole Colonial Empire.

The committee consists of :—Lord Lovat, Under-Secretary for Dominion Affairs (Chairman); Mr. Ormsby-Gore, M.P., Under-Secretary for the Colonies; Professor Sir J. B. Farmer, F.R.S.; Sir Graeme Thomson (Governor of Nigeria); Mr. A. S. Jelf (Colonial Secretary of Jamaica); Dr. A. W. Hill, F.R.S. (Director of the Royal Botanic Gardens, Kew); Mr. F. L. Engledow (School of Agriculture, Cambridge); Dr. A. T. Stanton (Chief Medical Adviser to the Colonial Secretary); Mr. O. G. R. Williams (Assistant Secretary, Colonial Office); and Major R. D. Furse (Private Secretary to the Colonial Secretary).

PLANT BREEDING.

The "Pure Line" Concept.

By J. B. Hutchinson, B.A.,
Assistant Geneticist at the Cotton Research Station, Trinidad.

The pure line concept was elaborated by Johannsen in 1903 and its importance was realised at once. Recently, however, several papers have appeared describing breeding experiments in which the theory and its implications appear to have been ignored.

A pure line may be defined as a group of individuals all possessing exactly the same hereditary constitution, and being entirely homozygous in the Mendelian sense. The only variation within such a group, and between successive generations of the line will be variations induced by varying environmental conditions. Selection in such a group is futile, because desirable individuals owe their desirability to some chance favourable factor in their environment, and not to their hereditary constitution. An example (*see* Table I) may be quoted from cotton (Rama Prasada ([1]) p. 26, Table 2 modified).

Table I.

Generation.	Ginning—per cent.									
	31	32	33	34	35	36	37	38	39	40
F12 ..	..	1	4	6	7	8	21	14	9	2
F13 ..	..	..	2	4	19	18	21	4	..	..
F14 ..	1	1	1	3	11	6	5	8	..	..

The parent of generation F12 had a ginning per cent. of 39.

One of the nine plants ginning 39 in F12 was selfed, and its progeny gave the distribution plotted as F13. A plant was selected from the high end of this distribution and selfed and its progeny determined and plotted as F14. Clearly, selecting high ginning individuals as parents has no influence in increasing the average ginning outturn of the progeny.

So far as ginning outturn is concerned, we are dealing with a pure line, and differences between individuals are not due to any difference in hereditary constitution, and therefore are not repeated in the next generation. Stated in general terms, within a pure line there is no correlation between the characters of the parent and the same characters in the offspring, and the determination of the parent offspring correlation for a character provides a method of determining whether there is sufficient genetic variability in the family to make selection for that character worth while. Two examples may be given of recent instances where experiments arranged to allow the determination of parent offspring correlations would have saved considerable time and trouble.

I.—*Ginning outturn in cotton (Rama Prasada, ([1]) Table I, modified.)*

See Table II.

Parent of F7 ginned 31 per cent.

Selection for high ginning per cent. ceased to be effective after F11 and after F14 the line was discarded. The calculation of the parent offspring correlation for ginning per cent. would have shown the line was pure at F12 and saved two generations work.

Table II.

Generation.	Ginning—per cent.																					Mean.
	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44		
F 7	1	..	2	..	8	5	2	1	..	..	1	..	..	..	..	..	..	..	..	..		29.5
F 8	..	..	2	1	..	3	5	4	7	9	1	2	..	2	..	..	..	..	..	..		32.6
F 9	..	..	2	4	4	5	4	9	8	5	13	14	16	11	3	1	..	..	..	..		34.4
F10	..	..	..	5	10	10	14	52	105	92	105	94	78	66	20	7	4	..	..	..		34.9
F11	1	1	1	..	..	..	2	4	11	12	29	25	40	55	47	28	17	10	6	1		37.4
F12	..	..	..	..	..	..	..	..	..	8	9	11	34	28	16	9	5	1	..	..		37.6
F13	..	..	..	..	..	..	..	3	7	26	92	122	115	51	16	6	2	..	..	..		36.2
F14	..	..	..	..	..	..	2	3	7	8	36	51	51	30	9	5	4	1	..	..		36.3

2.—*Selection of Burma Beans for Low Prussic Acid Content* (*J. Charlton* ([2])).

From an examination of the data given, it is clear that the lines dealt with were pure for HCN content from the start. This would be expected if the Burma bean is normally self fertilised, as commercial seed could then be regarded as a simple mechanical mixture of pure lines.

Taking lines K as examples:

Selected for low HCN content during seasons:

	1921-2	1922-3	1923-4	1924-5
K 113/28/25	0.0034	0.0032	0.0052	0.0036
K 159/84/15	0.0034	0.0027	0.0056	0.0033

The author comments: "Obviously, therefore, the effect of the bad season in 1923-4 has rendered four years rigorous selection entirely ineffective since the mean per cent. HCN in 1924-25 is practically the same as in 1921-22." Not at all. Selection never had any effect at all. The season 1923-24 happened to favour production of beans with high HCN content, but the genetic constitution of the line was not affected, as shown by the regression in 1924-25 to the mean for the line. A single experiment designed to show whether there was any parent offspring correlation in HCN content within the line, would have shown that no gain could be obtained by selection.

If selection within a pure line is ineffective, it follows that so long as it is kept from contamination either by mixing or by cross fertilization, a pure line will not undergo degeneration. Once the purity of a line is beyond question, rigorous annual selection is unnecessary.

Spontaneous changes occur at infrequent intervals in the hereditary mechanism of all plants and animals, such "mutations" occurring in a pure line must be eliminated or the line will become mixed. Very little is known about the rate at which mutations occur. No case of mutation in cereals had been recorded at the Cambridge Institute of Plant Breeding up to 1924. Muller and Altenberg ([3]) quoted by Mangelsdorf ([4]), estimate the rate of production of lethals in the X chromosome of Drosophila at once in a hundred generations, and Mangelsdorf ([4]) estimates that lethal mutations occur in maize as frequently or more frequently. Lethal mutations, being fatal, cannot contaminate a pure line. Supposing viable mutations are produced at about half that rate, and equally frequently in each chromosome, it seems probable that mutations may not be expected more often than about once in ten generations. Jones ([5]) concludes "some selection is needed in practically all forms to keep a variety true to type and up to its proper standard. With these precautions, pure lines in plants that are largely self fertilised are actually quite constant."

Conclusions.

(1) In selection work, propagating simply from the best individuals is not enough. Families should be grown from a series of individuals representative of the whole range of types found—good, bad and indifferent. Unless there is a significant correlation between the intensity of expression of the character in the parent, and its intensity of expression in the offspring, it is no use carrying the selection any further.

If considerations of time and space preclude growing families from a complete range of types, make one or two selections from undesirable types and grow them beside the desirable selections. If the line is pure, there will be no significant difference between the two selections.

(2) When a pure line is being carried on from year to year as a routine measure, rigorous annual selection is unnecessary provided protection from outside contamination is assured, but a periodical analysis is desirable to guard against contamination by mutation.

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1. Rama Prasada (1) "Variability in Ginning Percentages in Crosses of Indian Cottons. *Agri. Jour. Ind.* No. XXII (1927) Pt. I.

2. J. Charlton (2) *Mem. Dept. Ag. Ind. Chem. Ser.* Vol. IX No. I, 1926.

3. Muller and Altenberg (3) The rate of change of hereditary factors in Drosophila, *Proc. Soc. Exp. Biol. Med.* 17: 10-14.

4. Mangelsdorf (4) Genetics and Morphology of some Endosperm characters in Maize: *Conn. Agri. Exp. Sta. Bull.* 279 June, 1926.

5. Jones (5) *Genetics* P. 224.

THE British Empire Products Number of the *Times Trade and Engineering Supplement* which was issued in May, is comprehensive and well illustrated and includes articles on the various Empire products including grain, wool, fibres, cotton, tea, coffee, cocoa, rice, oils and fats, rubber, tobacco and cane-sugar. Surveys are given of the economic development of different parts of the Empire. On page 19, Major Walter Elliot, M.P., Chairman of the Research Committee of the Empire Marketing Board, contributes an article on Agricultural Research, and mentions the scholarship scheme for the training of agriculturists in colonial service. On the same page there is a reproduction of a photograph of the students of the Imperial College of Tropical Agriculture.

THE MIRRLEES WATSON COMPANY wish to advise their friends that the fire which occurred at their Works on 6th June, was much less serious than reported. It was confined to a certain number of patterns stored in open yard. The main Pattern Stores (fire-proof) and the Pattern Shop were practically untouched. No machinery was affected, and the Works continued in full operation without interruption.

WEST INDIAN NOTES.

(*Continued.*)

By SIR FRANCIS WATTS, K.C.M.G., D.SC.
Principal Emeritus.

CROPS at first grown for export in the West Indies were indigo, ginger and tobacco but these, however, quickly gave way to sugar when in about the year 1640 the knowledge of how to make dry, crystallised sugar was introduced into the West Indies from Brazil. How rapid the progress was, may be gathered from the fact that although Barbados was not colonised until 1625 and the knowledge of sugar making was not introduced until 1640, yet by about 1660, land in that island had become extremely valuable and difficult to obtain on account of the demand for it for sugar plantations. From that time onward the island has been mainly devoted to sugar production and the same may be said of St. Kitts and Antigua, while sugar growing in Jamaica, established about the same time, formed the basis of its great prosperity. In the seventeenth century sugar growing formed the principal agricultural feature of most of the West Indian Islands and it was from the West Indies that Great Britain and Europe generally derived their chief supplies.

It has been said that the course of European discovery in the East was largely determined by spices; similarly, perhaps it may be said that the course of events in the Western World has largely been influenced by sugar. The production of sugar in Barbados, Jamaica, St. Kitts, Antigua and practically in all of the West Indian islands caused them to become of great economic and political importance. They were almost the sole sources of supply, so that West Indian plantation owners became exceedingly wealthy and the islands were valued accordingly. As the outcome, West Indian affairs influenced in a marked degree English political and commercial affairs.

This feature had a distinct bearing on the development of the Empire. At a time when the general tendency in Great Britain was to consider that colonies were more likely to be a source of undue responsibility and risk to the mother country rather than sources of wealth and adjuncts of security, the sugar-producing colonies were more favourably regarded. It will be remembered that the feeling in the seventeenth and eighteenth centuries was that it should be the function of colonies to supply raw materials to the mother country and that they should not compete in the production of manufactured goods. In consequence, various repressive measures to regulate trade were put into force; trade was to be carried on by the colonies solely with the mother country and in British ships manned by British sailors; only raw materials were to be sent from the colonies, and, in turn, they must purchase the manufactured goods of the mother country and must not trade elsewhere. These ideas were those which largely influenced the trend of thought leading to the economic doctrine of free trade. The restrictions imposed in this connection frequently proved irritating and were amongst the causes leading to the revolt of the American colonies in 1775. The restrictions pressed less heavily on the sugar-producing colonies, though these colonies were frequently irritated by the Navigation Acts. The West Indian colonies, however, showed little or no tendency to join the North American colonies in their revolt—a matter of considerable moment to the mother country. Referring to this period, L. C. A. Knowles, the economic historian writes, "To most people the Antilles were the really important part of the English system; had Jamaica revolted Great Britain would certainly have put forth more effort to retain her than she did to retain North America." Here then is an instance in which sugar and the West Indies determined the future of the Empire.

Another series of happenings may be referred to in which sugar and West Indian interests had a marked bearing on the course of events which shaped the destinies of the Empire. During the Seven Years' War, and later during the Napoleonic Wars, the islands of Martinique and Guadeloupe on several occasions fell into the hands of the English and were occupied by them and one often wonders why they were not retained. The truth is that West Indian interests in England viewed with considerable alarm the addition to the English sources of sugar production of two such important sugar-growing islands, fearing that the influx of the large amount of sugar that they produced, coming into the English market as British-grown sugar with the privileges attached thereto, would greatly disturb English interests and render less valuable the monopoly held. Consequently the English merchants were loud in their demands that these islands should be restored to France, as actually happened, first in 1763 under the Treaty of Paris of that year, and again in 1814 under a second Treaty of Paris. It was in 1763 that Canada was annexed by the English and it is extremely probable that, had the decision been taken to retain Martinique and Guadeloupe, Canada would have been handed over to the French. Had that happened, the course of Empire might have been very different from what it has been. Why sugar exercised so preponderating an influence may be more readily appreciated when it is remembered that in 1700 England consumed only 10,000 tons of sugar and only 180,000 tons in 1800.

Sugar, having become the principal product of the British West Indies, remained so for a number of years, enjoying considerable prosperity until it began to feel the competition of the beet sugar grown in Europe. During the wars between Great Britain and France at the close of the eighteenth century, supplies of sugar were largely cut off from the latter country, to the great detriment of the inhabitants, and strenuous efforts were made to substitute sugar made from the beet, the possibility of which was discovered in 1801. The idea was eagerly fostered by Napoleon as a

war measure. So successful were these efforts, that beet-sugar industry of great magnitude was built up. This industry was aided by various grants and concessions so that in a few years it grew to such magnitude as to threaten the position of cane sugar, which was unable to compete against subsidised beet sugar, with the result that the West Indian sugar growers were in danger of being forced to abandon their industry, an eventuality which would have meant the ruin of the West Indian colonies. When this appeared imminent, a Royal Commission was sent to the West Indies in 1897 to report on the situation. It was represented to this Commission that the most careful thought had been unable to suggest industries which would successfully take the place of sugar in a number of islands, notably Barbados and the Leeward Islands, and that, while other islands might possibly support themselves by other industries, such as the growing of cacao or fruit, sugar was the only crop economically possible for certain of them, and that, unprotected against the bounties given to Continental beet sugar, it was impossible for them to continue their industry. The Commissioners recognised the truth of much of what the colonists had to say and made recommendations for combating the bounties to some of which effect was given at the instance of Mr. Joseph Chamberlain, then Secretary of State for the Colonies. In addition to these recommendations aimed at controlling the bounties given to beet sugar, the Commissioners felt that steps ought to be taken to assist the planters in the strenuous agricultural struggle with which they were confronted, and that steps should be taken to encourage and develop as far as possible other industries as well as sugar. It was thought that scientific assistance placed at the disposal of the planters would lead to such improvements as would stabilise West Indian agriculture and help these communities to become self-supporting.

In order to effect this the creation of the Imperial Department of Agriculture was recommended ; the funds for its maintenance for a number of years being provided by the Imperial Government. In the first place the new Department worked with and through the already existing Local Departments of Agriculture, which, largely through the recommendations of Kew, had been established in nearly every colony. Through the Imperial Department financial assistance was given to enable them to carry out the new activities which the Department advocated and to a large extent directed.

The aspect to which it is perhaps worth while directing attention is that the work was so developed as to establish intimate relationship between the planter and the officers of the Departments, and so with the Government, which operated to great advantage during the difficult time when so much was being done to rehabilitate West Indian agriculture.

A point which I wish to emphasise is that by a rational system of working the Imperial Department showed how Departments of Agriculture could be effectively administered and made to gain the confidence of the communities in which they operated. At the same time the officers themselves, while carrying out their duties, gained very valuable experience and useful training which caused their services to be in demand on the staffs of the Departments which were rapidly springing up in other tropical colonies, for which the Imperial Department with its associated local Departments served as a useful model and guide. It is interesting to note that there were men recruited from the Imperial and West Indian Departments on the staffs of the Departments of Ceylon, the Federated Malay States, Mauritius, Nigeria, Gold Coast, Gambia, Tanganyika, Nyasaland and Fiji. A very creditable position was thus established, and I venture to think, it may be claimed that in this way amongst others, the West Indies have exercised considerable influence on tropical agriculture.

This demand for and successful use of men trained in association with the Imperial Department of Agriculture lay at the root of the idea of establishing an Agricultural College in the West Indies as an extension of the work of the Imperial Department, hence arose the Imperial College of Tropical Agriculture.

While I might refer to several interesting lines of work carried out by the Imperial and associated Departments of Agriculture, I had, perhaps, better content myself by endeavouring to illustrate by one or two concrete instances how these Departments operated. For this purpose I may refer to the reintroduction of cotton growing. In your studies relating to cotton you will have been made familiar with many specific points connected with the industry ; I wish now to look at the matter from a broad point of view, mainly with the object of showing how planters, agricultural officers, and governments, worked intimately together over a long series of years and succeeded in establishing a cotton industry in these islands, in spite of many great and unexpected difficulties.

(*To be concluded.*)

MR. HENRY FOY.

MR. HENRY FOY, M.A., who held the post of Lecturer in Zoology at the College during the 1926-27 session, found it necessary for private reasons to resign his appointment at the end of the College year. Mr. Foy came to the College from the Biological Laboratory at Holt, Norfolk, of which he was Director.

Although his stay at the College was a brief one, Mr. Foy's resignation was received with regret. He excited the interest and enthusiasm of his students in his special subjects and it was obvious that he possessed the research spirit to a great degree. The best wishes for all future success will go with Mr. Foy from all at the College and in the community generally with whom he came in contact.

TROPICAL WORLD NOTES.

Nigeria.

The annual report of the Department of Agriculture of Nigeria for the year 1926 has recently been published and contains several items of general interest, of which brief mention will be made.

Cotton :—As was anticipated, the export for 1926-27 of American cotton from the Northern Provinces fell short of 16,000 bales, a decrease of over 50 per cent. from the figures of the previous year. The decline is attributed more to a bad season than to the fall in prices. On the other hand a good season in Southern Nigeria has been responsible for maintaining the export of native cotton at roughly 10,000 bales. In the Southern Provinces the standard for 1st grade cotton has been lowered from 6 per cent. to 11 per cent. stained and damaged seed cotton, but, even so, very little 1st grade cotton has been purchased. Abnormal rains which occurred when the crop was ripening in January and February undoubtedly depreciated the quality of the crop as a whole, and it is considered that in normal years the new standards will be of practical value. During the coming season an attempt is being made to multiply as rapidly as possible on native farms two pure strains of Ishan cotton which have recently been isolated. These cottons, while vegetatively similar to the ordinary native cotton of Southern Nigeria, are vastly superior to it in staple and ginning percentage, and there seems little doubt that their introduction will be instrumental in bringing about a vast improvement both in quality and quantity of the cotton exports.

Cocoa :—The co-operative fermentation and sale scheme, initiated by the department in 1922, has now largely served its purpose as an instructional measure in the Oyo and Abeokuta Provinces. During the past season the amount of cocoa handled under the scheme has fallen considerably, chiefly owing to the fact that exceptionally high prices have been offered for cocoa of almost any quality. In the Ondo and Benin Provinces the scheme has been successful in causing a revival of interest in cocoa and planting is proceeding apace.

Palm-Oil :—A proposal has been laid before the Secretary of State in which definite financial assistance is offered to firms prepared to erect pioneer palm-oil factories. It seems probable that, unless a large scale plantation were attached to it, a factory might find it difficult if not impossible to purchase at a fair price sufficient raw fruit to maintain it. Leases of large areas in most parts of the oil palm belt are out of the question owing to the density of the population, but it is believed that there are areas either on the fringes of the belt, or which are suited to oil palms, where the native communities concerned would not be adverse to leasing. At present almost all the palm-oil exported from Nigeria is obtained by native hand extraction methods. While various simple processes have been devised whereby the native can obtain both more and better oil than he does by his traditional crude methods, the cost of the necessary apparatus comparatively trifling though it is, has proved too great an obstacle to the innovation in this country of peasants. A simple and inexpensive press is now under trial, but should this in turn fail to appeal to the native worker, it will be concluded that it is not feasible to devise a process of hand extraction which is sufficiently great an improvement on the ordinary native methods to induce the producer to adopt it and to purchase the apparatus necessary.

Produce Inspection :—A scheme of produce inspection which was inaugurated in April, 1926 has, after certain amendments to the initial regulations, worked smoothly and has achieved conspicuous success, even within a year, in raising the quality of Palm Kernels and Cocoa. It seems likely that the scheme will be extended in the near future.

C. J. L.

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Mauritius.

Final figures on the Mauritius sugar crop of 1926-27, reported by the Department of Agriculture of the colony, give the total production as 192,590 metric tons, compared with 241,220 tons in 1925-26 and an average of 239,220 tons annually for the five years 1921-22 to 1925-26. The final outturn was slightly below the preliminary estimate of 196,000 tons made in December, as weather conditions toward the close of the grinding season were very unfavourable and the sucrose content of the cane fell off considerably. The quantity of cane crushed was 1,938,000 metric tons, of which 862,000 tons belonged to factory estates. The average extraction of sugar per cent. of cane was 9.94. Exports of sugar from Mauritius from 1st August, 1926, to 15th January, 1927, were 104,990 metric tons, compared with 150,811 tons in the corresponding period of the previous year.

* * *

British Guiana.

A Government motion to pay an annual subsidy of £3,300 for three years from 1st January, 1928, to the British Guiana Air Transport Company, Limited, has been accepted by the British Guiana Combined Court. For this sum the Government is to have the use of the company's seaplane or seaplanes for 160 hours each year with a view to the encouragement and promotion of aviation in the Colony.

This agreement concludes somewhat protracted negotiations between the Government and the company's representative in Georgetown. The machine at present in the Colony is a Fairey seaplane which was brought out some two years ago for service with the Real Daylight Balata Syndicate, and which has also, on various occasions been employed for official purposes.—*The Times.*

OBITUARY.

Sir Arthur Shipley, G.B.E., F.R.S., M.A., Sc. D., etc.

The Chairman of the Governing Body of the Imperial College of Tropical Agriculture (Sir Arthur Shipley) passed away at Cambridge, aged sixty-seven, on 22nd September, 1927. His death is a sad loss to the College.

Sir Arthur's career was a notable one. The son of the late Alex. Shipley of the Hall, Darchet, Buckinghamshire, he was educated at University College School and Bartholomew's Hospital and then went on to Cambridge where he joined Christ's, the College of which in 1910 he became Master and administered until the day of his death with conspicuous success. He held various important positions in the University, being Secretary of the Museums and Lecture Rooms Syndicate and University Reader in Zoology. He was Vice-Chancellor from 1917-19.

His devotion to his University and his College was striking and he was a fund of knowledge on the history and traditions of the old town, publishing many interesting works on this subject. His contributions to our knowledge of the modern science of Zoology are notable, and he was the author of numerous works and text books on this and allied subjects to which space will not permit of more detailed reference.

His interest extended far beyond Cambridge University, and he was truly imperial in his outlook. He was one of a group of distinguished men, who realized the importance of applying scientific methods of research to the problems of the Tropics and in later years, particularly since the commencement of the war period, his interests tended more and more in this direction. It was only natural therefore that he should become interested with the late Lord Milner and others in the development of agriculture in His Majesty's Tropical possessions and he was one of the first to realize the enormous possibilities that this field affords by the application of scientific agricultural methods. He was one of the first to realize also that this development could not take place until a trained staff had been made available.

The realisation of the dearth of trained men and therefore of the necessity for affording means of training, resulted in the idea of a Tropical Agricultural College and this is the genesis of the existing institution in Trinidad. Sir Arthur realised his ambitions in this direction and became first chairman of the Imperial College of Tropical Agriculture in 1922.

His activities during the war were exceptional and his extensive scientific knowledge was of great service to the nation at war and was freely given. He was a member of the Central Medical and other war committees and was frequently called in by the Government to advise on economic matters. He accompanied a special mission to the United States for the British Government towards the latter end of the war.

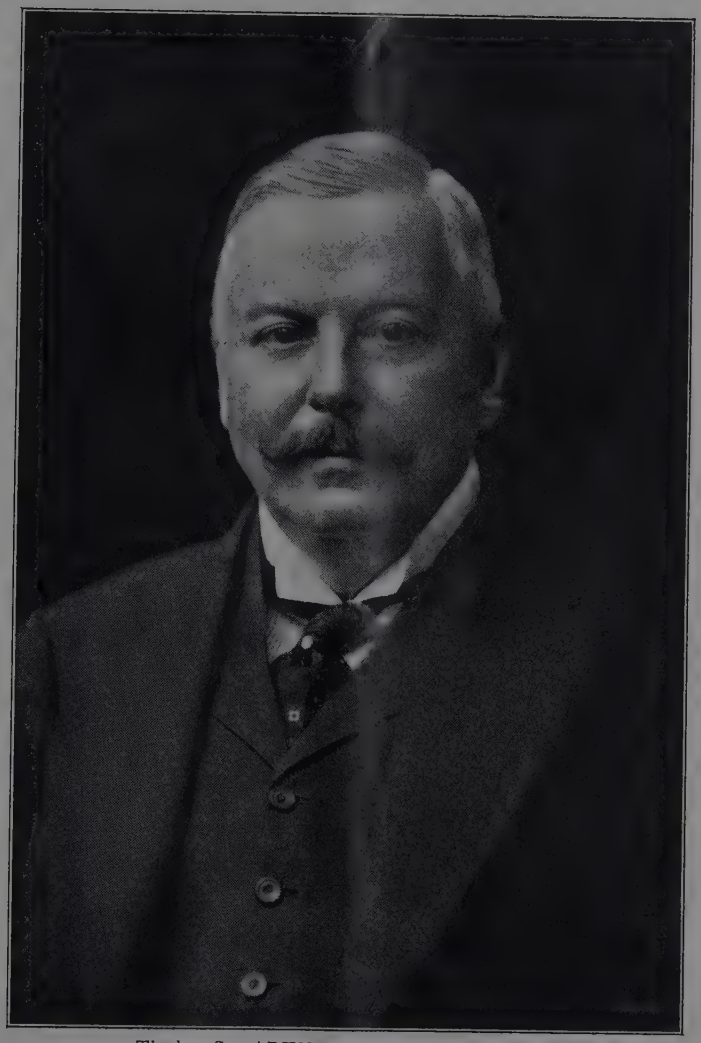
From the purely personal point of view Sir Arthur was a most interesting man to meet. He was a great traveller and in the course of a life devoted to the cause of science he had visited many countries and had made the acquaintance of an astonishing number of people prominent in all walks of life. He was a good after dinner talker, blessed with a good memory and an abundant wit, and was an altogether delightfully amusing companion. Some of his stories about places and personalities are already almost regarded as classics.

His services to the Imperial College of Tropical Agriculture are difficult to calculate. It was, in fact, due in a large measure to his own personal endeavours and continued enthusiasm that this College came into existence. At home he made numerous personal appeals and led deputations to the Secretary of State on behalf of the College and during his visit to the West Indies in 1922 his admirable social qualities combined with his wonderful wit were successful in raising substantial funds towards the finances of the College.

His last visit to the West Indies was in February of this year, when he stayed for three weeks in residence at the College. He was genuinely pleased and surprised at the rapid progress that had been made since his previous visit, and on leaving, expressed the greatest gratification at seeing one of his greatest ambitions realized. He left the College very much benefited in health and so full of energy, that he was planning a trip to the Amazon in the summer. However, he caught a chill on the voyage home and after a temporary return to convalescence during the past summer died suddenly in September, the news of his death casting a gloom over the whole College.

Before he left Sir Arthur addressed the whole College on the subject of "Life" and his views on this subject and particularly with reference to old age were of great interest and were of a somewhat unusual nature. The following quotation was perhaps typical of his attitude towards the subject:—

"Anyone who has lived through the last sixty years, as I have, must recognise that in spite of temporary set backs the world is a better, a cleaner and kindlier place to live in than it was in the middle of the last century. Mankind does advance slowly, if you like. He is said to have taken 50,000 years to learn how to produce a polished arrow, or kelt from a flaked one, but still in the end he did produce it, and it was a great advance in civilization."



The late Sir ARTHUR EVERETT SHIPLEY,
G.B.E., LL.D., Sc.D., F.R.S.

Tanganyika.

AGRICULTURE IN 1926.—The promise of a particularly good season was marred as regards the principal annual crops, cotton and ground nuts, through the weakness of markets, whereby native producers (who grow all the groundnuts and approximately two-thirds of the cotton) held back or destroyed a large proportion of their produce, the export in the case of groundnuts being reduced through financial stringency which lessened the extent of advances for buying. The export of cotton, nevertheless, increased and the quality of that part of it belonging to the season of 1926 (September onward) was very good throughout the Territory: actually the best that has so far been produced. The following export figures are given for the principal products of the Territory for the pre-war year 1913 and the years 1924, 1925 and 1926 :—

	1913.		1924.		1925.		1926.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Cwts.	£	Cwts.	£	Cwts.	£	Cwts.	£
Sisal fibre ..	416,680	535,580	368,560	644,835	365,520	688,451	500,440	911,293
Cotton ..	43,840	120,753	50,828	373,710	90,043	540,481	97,723	427,437
Ground-nuts ..	179,220	95,932	373,680	359,918	181,100	178,685	317,340	254,903
Coffee ..	21,180	46,563	105,222	352,529	120,186	481,055	130,793	495,199
Copra ..	109,540	117,401	162,500	178,194	152,460	160,800	146,960	152,228

2. Sisal fibre has at length exceeded the pre-war production, due to the continued rehabilitation and improvement of old plantations and to some extent the opening of new areas. The increased export of coffee, of which the almost purely native industry of Bukoba produced 71 per cent. by weight was due not only to favourable conditions of season but to recent plantings that are coming into bearing.

3. Of these products, groundnuts are grown entirely by natives, sisal fibre entirely by non-natives and the remainder by both natives and non-natives.

H.W.

West Indies.

The Port of London Authority at their meeting on Thursday last, by placing the contract for the second portion of the scheme for the improvement of West India and Millwall Docks, showed the importance they attach to the modernisation of this section of their estate. The work consists of the construction of a new entrance lock to the South West India Dock 590 ft. long by 80 ft. wide. The first part of the improvement, involving the cutting of passages connecting the hitherto separate West India Import Dock, West India Export Dock, South West India Dock and the Millwall Docks, is now well advanced. On the completion of the whole scheme this system of docks will be able to accommodate vessels of much larger tonnage than is possible at present. The contractors in this case are Sir Robert McAlpine and a further contract was also placed with John Mowlem & Co. for the erection of three new specially designed storage sheds for softwood at the Surrey Commercial Docks. With regard to the new Tilbury Dock, which work is being carried out at a cost of £2,500,000, it is anticipated that it will be completed a full year ahead of contract time.—*Syren and Shipping.*

Malaya.

An industry which, if we except the canneries at Klang, is essentially an industry of the Straits Settlements, and progress in which seems to call for more than a passing reference, is the canned pineapple trade. Twenty years ago the annual export of canned pineapples amounted to something in the neighbourhood of 400,000 cases; by 1913 the figure had gradually risen to 750,000 cases, and to-day it has reached the exceedingly satisfactory level of something in excess of 1,250,000 cases. About 80 per cent. of the pines nowadays imported into the United Kingdom are Malayan, and the fruit is continuing to gain steadily in popularity; there is no reason, therefore, to suppose that the high-water mark has been reached. In August last year an amalgamation took place of all the canneries of Singapore, Johore and Klang, under the name of the Singapore United Pineapple Packing Co., Ltd. Simultaneously with this unification came the innovation of totally eliminating lower-grade fruit and using white sugar instead of brown, whereby the flavour has been immeasurably improved.—(*Chamber of Commerce Journal,* Vol. LIV, p. 302.)

LIVESTOCK IN THE TROPICS.

A. L. BAKER, B.SC. (Agric.).

IN the old established agricultural countries of the North, the keeping of livestock and production of marketable animal products plays just as important a part in the general economy of agriculture, as does the growing of crops. Here the importance of maintaining the humus or organic matter in the soil has long been understood. Consequently, in nearly all types of farming, stock and crops are judiciously blended. Crops are consumed by stock and the manure returned to the land to maintain its fertility. Furthermore, the fertility of the soil can be maintained without recourse to heavy applications of purchased manures, and products such as straw, which might otherwise be of little or no value, can be profitably fed to stock, while the distribution of labour throughout the year is usually more uniform and economical. The point to be emphasized, however, is that under old and well established conditions of agriculture, the importance of the inter-relationship of crops and stock cannot be over-rated where the policy is to crop the land continuously, and at the same time to keep it in good heart.

Turning to the tropics, an entirely different state of affairs presents itself. Here, generally speaking, crop products are far more important than livestock, and with the exception of perhaps India and Rhodesia, little or nothing has been done to develop a livestock industry. Stock do exist in all tropical countries, but up to the present their development has been almost entirely along lines suitable for the production of working animals, and little attempt has been made to produce animals more suitable for milk or meat or wool. In some of the earlier developed tropical countries, such as Trinidad, the effects of soil exploitation are already manifest. Growing the same crop year after year, without adequately compensating the soil for the organic matter and mineral constituents removed, has resulted in the exhaustion of much of the land, and in the incidence of disease, due both to lack of vigour in plants and the absence of rotations. When it is remembered that the breakdown and utilisation of humus is extremely rapid in tropical soils, the problem becomes more acute. Hence any increase in the number of livestock with the consequent production of more organic manure is bound to be a step in the right direction. Under such conditions, and especially where systems of "one-cropping" are practised, any diversification of agriculture must prove advantageous.

It is not the writer's opinion or idea that animal industries, similar to those of the temperate zones might be established in the tropics. It is doubtful whether this is desirable, even were it possible. In the first place, cattle or livestock as a whole are less suited to tropical than to colder climates, and moreover the demand for meat and other animal products is less in the tropics. This is due to several causes, one of which is that many native races, such as the Buddist and Brahmin population of India are vegetarians, and others are only small eaters of meat. It is also recognised by medical science that people living in the tropics require less meat than those of colder countries. The chief point at issue is not so much the establishment of new industries, but the improvement and where desirable, increase in numbers of the already existing domestic animals of the tropics, which at present somewhat inadequately supply the needs of the population. For example, by scientific feeding and management, it would doubtless be possible to double the milk yield of many of the scrub cows, which are so common throughout the equatorial zones, without any appreciable increase in cost.

To those familiar with northern livestock, it would seem at first sight that all that is required is to import quantities of the improved breeds of the North and build up improved herds from them. This has often been done on a large scale, but in more cases than not, with disastrous results. It must be realised that immediate and complete reformation of livestock in the tropics can never be attained. For various reasons, the process must necessarily be a slow one, but provided the initial steps are based on sound and businesslike lines, there is little reason why, given time, satisfactory and desirable results should not be obtained. In the first place, it has been found by experience that only certain of the northern breeds of stock are in any way adapted to withstand tropical conditions, and even with these, there are often many difficulties to be overcome before they can be successfully established. Cattle from the north often fail to thrive in the tropics, and rapidly deteriorate or die from disease to which they are usually far more susceptible than the naturally more resistant and acclimatised native breeds. As a consequence, the attempt to grade up native cattle by the use of northern stock, lacking in vigour under tropical conditions has often ended in complete failure. Experimental work on a small scale has first to be done, and then, only those classes of livestock which have been proved by experience to give satisfactory results should be used on any extensive scale. The precaution of inoculating all imported sires against redwater disease before shipment, and the introduction of animals at an early age, when their natural resistance is high, would allow them to become acclimatised before service and possibly to acquire natural immunity, and might do much to reduce the present somewhat high death rate amongst bulls. It must be emphasized that where male animals are imported with the object of grading up native stock, only superior sires having desirable characteristics and of known ancestry and prepotency should be used. And even with the native cattle themselves, much improvement may be obtained by the ordinary methods of selective breeding, and by the avoidance of haphazard and undesirable matings which are at present so common.

There is a wide field open for research in the tropics, both in the sphere of organised breeding, scientific feeding, management and sanitation. With regard to feeding, the amazing strides and almost incredible results which have been obtained in the last few years in the science and economics of this important subject, by such men as James Mackintosh at Reading, and Boutflour in Wiltshire, tend to show that work in the tropics is sadly behind-hand in this respect. One of the stumbling blocks to progress in the science of feeding outside temperate countries at present, is the fact that little or nothing is known about the digestibility of some of the locally grown foods. But here again, important work in this connection has been initiated in India, and when conclusive results are obtained, they should give a great stimulus to the practice of systematic rationing. From the point of view of the availability of foodstuffs, in the matter of concentrates, the tropics are well supplied. Besides an abundance of foods rich in starch, foods of high protein and oil content such as pulse grains, cotton seed and coconut residues, &c., are easily obtained locally. In the case of green forage, while much of the grazing land may be of poor quality, it can be easily supplemented by soiling crops, cut and fed green. Elephant grass, Para grass, Guatemala grass, sugar-cane tops, sweet potato vines, green pulses, &c. could be utilised for this purpose. Silage from these materials could be made to tide over the period of the year when green stuff is scarce or unobtainable.

While, in many countries, local departments of agriculture are doing much to improve generally livestock by the establishment of Government Farms, where good stud stock are kept and are available for use on the native cattle, the process of grading up must necessarily be slow, unless supported by strong legislation. Only male animals licensed by the Government, after examination by a competent veterinary surgeon, should be allowed to be used for service. These animals, should be declared free from disease, and of sufficient quality to improve rather than degrade the native herds. This might mean the enforcement of compulsory castration, and from the humane point of view, only qualified men, certified as such, should be allowed to perform this operation, as native unskilled methods may often prove both crude and cruel. Inspectors empowered to inspect native stock, and to enforce proper sanitation, feeding and management in cases of obvious neglect would be required, and certain diseases would have to be made notifiable to the police. Government subsidies on really good sires have gone far towards producing some of the more famous breeds in temperate countries, and this is a practice which might well be emulated to advantage in the improvement of stock in the tropics.

The Editor will be pleased to send a gratuitous specimen copy of *Tropical Agriculture*, post free, to anyone interested in tropical development.

RESEARCH IN SUMATRA.

THE report of the Director of the General Experimental Station of the A.V.R.O.S. in Sumatra for the year ending June, 1926, contains several items of interest.

The station is concerned primarily with rubber in which it has been carrying on selection for some time. During the year under review, 60,800 seeds and between 60,000 and 70,000 metres of budwood were distributed to estates. Seedlings raised from crosses made in 1919 and 1920 were tapped, and the best selected for propagation by budding. The scheme at present being developed is to have a number of isolated seed-gardens, each about 5 hectares (12 acres) in extent, and to plant each with budded material from one tree only, the various mother trees used being those which have already been proved to give both good seedling progeny and good vegetative progeny. In this way a supply of seed and budwood of known value will be available for distribution and for further selection work. The selection of good mother trees is being continued.

Trials were made with various cover-crops and green manures under the rubber. In a young plantation excellent results were obtained by planting first Mimosa (species not stated), and eighteen months later *Calopogonium*, thus forming a mixed stand. It is intended to add *Vigna* or *Centrosema pubescens* to replace the present species as the shade of the rubber increases.

Selection work with oil-palm was kept up, and a number of new crosses and self-pollinations made. The Station plans to do selection work with tea, but has been prevented by lack of ground, a trouble which is also hindering it in other directions. Obtaining sufficient land is always a first essential with an institution working on permanent crops, and is often a serious problem.

The programme for the current year includes, in the Botanical Section, continuation of Hevea selection, and careful investigation with buddings of the influence of the stock on the scion ; oil-palm selection, within the Deli variety already established, and from new varieties ; cytological investigation of the flowers and fruits of the oil-palm ; and research on the diseases of the same plant. The Agricultural Section is carrying on and extending manurial experiments with rubber, oil-palm, coconut, tea, coffee, and other crops ; cultivation and tapping trials with rubber ; cultivation and selection work on tea and coffee ; and tests with new crops, *inter alia* Roselle, which the tobacco companies use extensively as tying material. The Chemical Section is concerned with investigations touching the technology of rubber, palm oil, and tea ; trials of the preparation of desiccated coconut ; tests of leaf samples from wild gutta trees, with a view to finding useful material as a basis for selection ; the working out of a method for determining the gambir content of gambir leaves ; and research on the best methods of preparing fibres, especially Roselle.

E. E. C.

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

Composition of Limes resistant to Withertip.

In a report on an official visit to Dominica, B.W.I., made in September, 1926, Mr. F. H. S. Warneford, of the Leeward Islands Laboratory, presents some interesting results of a comparative examination of several new varieties of lime introduced some time ago into Dominica. An abstract of his analytical data follows :—

	Juice content.	Citric acid content.	
	Percent. by weight.	gr. per 100cc. juice.	oz. per gall. of juice
Eustis limequat	39·6	7·52	12·0
Rangpur (green)	42·6	7·37	11·8
Kusaie (green)	37·5	6·86	10·9
Bears's seedless (green)	46·8	6·81	10·9
Woglum's seedless (yellow)	53·0	6·30	10·1
Kusaie (yellow)	46·7	6·23	10·0
Rangpur (yellow)	41·7	5·95	9·5

The Kusaie lime bears a fruit similar to that of the "*nobilis*" group of orange (*e.g.*: the mandarin orange). The unripe (green) fruit possesses a much higher citric acid content than the ripe (yellow) fruit, but the flavour and aroma of its juice is quite different from that of the West Indian lime.

The Bears's seedless lime, on the other hand, resembles closely the West Indian lime, not only in aroma, but also in the fact that the ripe fruit contains a greater proportionate amount of citric acid than the unripe fruit.

* * *

Variation in Composition of Bay Oil.

A preliminary investigation into the variation in phenolic content of West Indian bay oil is described in a report made by Mr. F. H. S. Warneford of the Leeward Islands Laboratory, B.W.I., on his visit to Dominica in September, 1926. It had previously been noted that bay trees growing in certain districts of Dominica yield oils containing abnormally high contents of phenols. This may be due to the fact that a different variety of bay tree characterises these districts. The question is being studied in detail by the Assistant Curator of the Dominica Botanic Gardens (Mr. Wright), who analyzes annually some fifty to one hundred samples of Dominica bay oil obtained from various localities. Careful records are to be kept in future so that the suggested correlation may be tested.

Synthetic Nitrogen Industry in Great Britain.

At the Edinburgh meeting of the Society of Chemical Industry, Col. Pollitt read a paper on the above topic, in which he described the synthetic nitrogen plant erected at Billingham-on-Tees in 1923. This plant isc apable of producing 250 tons of ammonium sulphate per day. The sulphate part of the fertilizer is obtained, not from sulphuric acid, but from anhydrous calcium sulphate (anhydrite) which is mined in the district. A similar nitrogen plant is in course of erection, and also by-product plants for making nitric acid, ammonium nitrate, ammonia and ammonium carbonate. From these substances, concentrated fertilizers will be manufactured. These developments will enable Great Britain soon to challenge her chief competitor in the synthetic nitrogen industry—Germany, and also to reduce the price of nitrogenous fertilizers, so that they will become cheaper than Chile sodium nitrate. They will also render Great Britain independent of other countries for her supplies of these fertilizers.—*The Industrial Chemist*, August, 1927.

* * *

Dusting by Airplane for Sugar-Cane Moth Borer Control.

During the autumn months of the present year, a large-scale attempt is to be made in Louisiana to control the sugar-cane moth borer by means of sodium fluosilicate dust blown from airplanes. An expenditure of $50,000 for this purpose has been authorised. Some 5,000 acres will be dusted.

The moth borer is said to damage annually between 15 and 30 per cent. of the sugar-cane crop of Louisiana. The most effective plantation method for destroying the moth so far discovered is to soak the cane cuttings used for planting, in water for seventy-two hours. It is believed, however, that the airplane dusting method will prove to be equally effective, and, at the same time, much more economical. The dusting trial will be supervised by the Bureaux of Entomology and Plant Industry, working in co-operation with the American Sugar-cane League and the University of Louisiana.—(*Ind. Eng. Chem.* August, 1927, p. 953.)

* * *

Colour Tests for Vitamins.

Dr. S. G. Willimott and Dr. F. Wokes of the Universities of Cambridge and of Liverpool, have attempted to develop suitable colour tests on various foods of known vitamin content, in order to detect and to estimate vitamin A, which is the growth-promoting substance of foods. They found that antimony trichloride gave the most satisfactory test among the reagents tried. This compound produces a beautiful blue colour in the presence of vitamin A. The depth of colour gives some measure of the quantity of vitamin A present, but the technique of the method is delicate, and needs further investigation before it can be used with confidence.

KAPOK.

SOMETIME ago attention was drawn by the *Bulletin of the Imperial Institute* to the extension of the production of Kapok within the Empire.

This floss is the product of a number of trees, the commercial variety coming from *Eriodendron anfractuosum*. Under natural condition the tree attains considerable size but cultivated varieties are usually slender and about 50 feet in height, having easily recognisable characteristics, the branches being horizontal and arranged in tiers. The hairs which are the basis of Kapok spring from the inner wall of the fruit which is a more or less oblong capsule about 6 inches long and 2 inches in diameter.

These hairs are cylindrical, from 0.6 to 1.2 inches in length, the cells full of air, and very light. Their resiliency and impermeability to moisture recommend them for many special uses. In the manufacture of buoys, life belts and life saving jackets, Kapok proves a very buoyant material. Lightness, resiliency and its non-hygroscopic and non-absorbent qualities make Kapok very suitable for stuffing cushions, pillows, mattresses and similar articles. Its potentialities have led to its trial as a textile fabric, and the initial difficulties arising from the smoothness of the hairs now having been overcome, yarns are being produced suitable for plushes, lace and other materials. For clothing, the wearing properties are less good than those of cotton, but its non-conducting character should make Kapok valuable as an interlining in warm clothing.

The initial processes of extraction of the floss are always done by hand, chiefly by women and children. After the floss and seeds have been removed, the subsequent separation of the floss from the seed is the most important process. When the Kapok is produced on a large scale, machine cleaning is used, and the product is carefully graded to facilitate marketing.

The raw Kapok, being bulky, is pressed into bales, but care must be taken not to destroy the elasticity of the fibre by over-pressure.

In recommending the extension of any crop it is necessary to bear in mind the reaction on price of increases in the supply. With regard to Kapok, in spite of a set back in 1924, it is the opinion of the merchants that demand is increasing so that there is room for expansion without the set back of decreasing price. For instance, the United States cannot organise any advertising campaign in favour of Kapok products for fear of inadequate supplies to satisfy the created demand.

It is relevant here to review the suitability of various parts of the Empire for the production of Kapok.

Take the Asiatic possessions. The hot moist tracts of West and South India together with Burma are eminently suitable but there is no systematic planting. The material, however, is held to be of good quality. The trade in 1923-24 was as follows:

Exported to	*Tons.*	*Value.*
United Kingdom ..	448	—
Netherlands ..	272	—
Germany	210	—
France	196	—
Italy	140	—
United States of America	110	—
Australia	73	—
Other Countries ..	243	—
	1,692	£136,000

The tree is common in Ceylon and widely distributed, but the export has been small—300 tons of recent years. The quality is intermediate between Javan and Indian.

In Malaya peasants grow the tree extensively and the land is suitable for the production of Kapok under commercial conditions. The Agricultural Department has recently inaugurated a scheme for collecting the pod and selling the floss and seed.

The tree is found in most of the British Colonies in Africa. In West Africa it reaches a large size but no systematic attempt has been made to gather the floss except in Togoland, where Kapok received special attention under the German regime. The establishment of an extensive export trade would, however, be dependent on the development of a satisfactory transport system. Samples from Gambia and the Gold Coast indicate that a product of good quality could be grown there.

East Africa had an increasing industry in Tanganyika before the war. Later the plantations suffered damage from elephants, but the industry is reviving. The local Department of Agriculture, however, does not favour its extension on the ground that the tree is liable to harbour insects which may spread to the cotton fields. Suitable Kapok is produced from trees in the Sudan, on the coastal regions of Kenya and from the boundary trees of Zanzibar.

The tree is found in most of the West Indies but the scattered distribution makes collection for export improbable; its destruction was made compulsory in St. Vincent because it harbours a cotton stainer.

In Australia, the tree can be grown practically along the whole of the Queensland coastal belt from Brisbane northwards. At the same time there is a domestic market which is now satisfied by Kapok from Java. It has been suggested that the most profitable method of its extension in Australia would be to plant the trees as wind breaks or shade trees rather than in the form of plantations.

Exportable crops were raised in New Guinea, but high costs of production owing to lack of adequate transport facilities has led to abandonment of the plantations. North Borneo is suitable but the trade has made little progress because the floss has mostly been shipped in an uncleaned state. In Samoa the tree grows practically wild and is chiefly used as a wind break in cocoa plantations.

G. W.

SUGAR NOTES.

Compiled by the College Department of Sugar Technology.

Large Crystallizer Capacity Not Essential to Obtain Low Purity Final Molasses in a Raw Sugar Factory.

Will sugar crystallize out of a solution sufficiently rapidly so that molasses of 40.0 gravity purity can be obtained at the moment the massecuite leaves the pan? Arnold H. Warren, writing in *Sugar News*, 1927, Vol. VIII, No. 6, pp. 445-448 says that it will, his experience indicating that the following boiling conditions are necessary :—

1. The Apparent Purity of the massecuite should not exceed 60.0, and should be preferable between 55.0 and 58.0.

2. The grain should be small. The writer drew in for graining about 1 litre of syrup of 65.0 Brix for each 4 litres of massecuite to be produced. It is probable, however, that equal good results could be obtained with a larger grain provided the massecuite were boiled more slowly.

3. The Apparent Purity of the first molasses employed was below 50.0. It is probable that if first molasses of above 50 purity were employed it would be necessary to boil the massecuite more slowly to give time for the additional sugar to crystallize out.

4. The boiling of the low grade strike should be carried on very slowly. No hard and fast rule can be given. The pan used was a calandria pan having about one square foot of heating surface per cubic foot of capacity. After the graining was finished and the drawing in of the molasses had been begun the steam pressure on the calandria was not at any time allowed to exceed 5 lb. The time required to boil a strike was between 5 and 6 hours. Better results might have been obtained if the boiling had been done somewhat more slowly.

5. The Brix of the massecuite as discharged from the pan should be between 95.0 and 96.5.

6. Care should be taken to avoid the formation of any false grain during the boiling, as this would make it extremely difficult to purge the massecuite without the use of water or steam which would, in turn, raise the purity of the resulting molasses.

Probably the chief cause of the formation of false grain in low grade strikes is boiling too rapidly. Slow boiling serves the double purpose of preventing the formation of false grain in the pan and of giving time for the maximum amount of crystallization to take place in the pan. Furthermore if the molasses has already been reduced to 40 gravity purity, or thereabout, before the massecuite is discharged from the pan, there is extremely little danger of the formation of false grain after the massecuite leaves the pan no matter how fast it is cooled.

The writer during the period 3rd February to 28th March, 1927, boiled a total of 24 low grade strikes not one of which passed through a crystallizer. Each strike was dropped from the pan directly to the mixer above the centrifugals. Four strikes were allowed to stand in the mixer from 6 to 12 hours before drying was begun. The drying of the remaining 20 strikes was begun immediately after dropping into the mixer. It required on the average about 16 hours to dry each strike. Hence where drying was begun immediately the massecuite had an average of $16 \div 2 = 8$ hours in which to cool during the process of drying. It is worthy of note that the mixer was not equipped with stirring paddles. As a result the cooling of the massecuite in the mixer was not uniform.

The results obtained by the writer indicate that :—

1. The gravity purity of the final molasses can be reduced to 40.0 without the use of crystallizers of any sort provided the boiling is properly done.

2. The massecuite when dried hot dries much faster than when dried cold. This is an important consideration when the low grade centrifugal capacity is limited.

3. The polarization of the "B" sugar averages higher for massecuite dried hot than for massecuite dried cold. This means that the low grade sugar can be worked up into 96 degree sugar with less pan work than is the case with "B" sugar of lower polarization. This may be an important consideration if the pan capacity is limited.

The writer does not wish to infer, however, that crystallizers are not a desirable part of the equipment of a modern raw sugar factory. There is no question but that a massecuite when cooled to a temperature of 30°C. will yield a lower purity molasses than the same massecuite will yield when dried hot at a temperature of say between 60°C. and 65°C. A massecuite which when dried hot yields molasses of 40.0 gravity purity should if cooled to 30°C. yield molasses of between 33 and 37 gravity purity.

The writer does believe, however, that the lack of what has, hitherto, been considered adequate crystallizer capacity cannot be considered a reasonable excuse for not getting the purity of the final molasses down to 40. He is of the opinion that with sufficient crystallizer capacity to permit cooling each strike a minimum of 24 hours no difficulty should be experienced in keeping the gravity purity of the final molasses below 40 provided the boiling is properly done.

* * *

Use of Sugar-Cane residues as a fertilizer.

W. Nathan-Levy writing for the *Bull. Assoc. Chim. sucr. dist.* 41—1924 notes that fertilizer can be made from ashes of megass furnace, defecation scum, and distillery slops. The cinders, ground fine, are put into a large brick reservoir and the scum added. When the mixture is dry, the slop is run in. The mass reacts, dries and is ready for use at the end of ten months. A typical analysis is H_2O and volatile, 25·8; total N 1.0; P_2O_5, 4·2; and soluble K_2O 3·3%.

REVIEWS.

A GEOGRAPHIC RECONNAISSANCE OF TRINIDAD. By Preston E. James (University of Michigan). *Economic Geography*, 1927, pp. 87-109.

Professor James visited Trinidad in 1924 to pursue vacational studies in economic geography. This article records the results of his investigations. Although Professor James did not stay in the Island very long, he has amassed an amazing amount of information, which he has clearly and interestingly presented. The subject matter is illustrated by seven maps, two graphs and ten pictures.

About 40 per cent. of the land area of Trinidad has been cleared for agriculture. It supports nine geographic divisions called districts. Of these, the Sugar District is divided into two communities, north and south of the Central Range, and the Cacao District, into four communities, namely, Northern Valley, Sangre Grande, Montserrat and Southern. There are three Coconut Districts; a Northern Range Peasant District, an Undeveloped South-eastern District, and an Oilfields District. Each of these is described in considerable detail.

Professor James concludes that the coconut industry of Trinidad is just passing out of the first stage of geographic adjustment, in which haphazard use is made of accessible high-grade sites. The cacao industry is passing out of the second stage, in which crops are grown on any new site that is sufficiently virgin-rich and inexpensive to be profitable. The sugar industry has passed through this phase to the third, where intensive cultivation, requiring considerable capital, and necessitating scientific studies of land and crops, is practised in close adjustment to environment. Evidently, Trinidad is an ideal place for studying tropical agriculture in the throes of development. Professor James' inspiring article should prove of considerable usefulness to students at the Imperial College.

F. H.

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DIE ZYTOLOGIE DER BLUTENPFLANZEN, Von Dr. P. N. Schurhoff, Ferdinand Enke, Stuttgart, 1926. Price M. 54.

This textbook on the cytology of flowering plants is in two parts. The first part is general, and covers in an efficient manner much the same ground as the standard British and American works of similar scope. It is for the second part that the book is of special interest to other than German botanists. This is a systematic review of all the known facts about the gametophytes, nuclei and chromosomes of flowering plants, family by family and genus by genus. With this valuable compilation at hand it is possible in a few seconds to ascertain the salient cytological points of any given genus, and if further details are wanted the sixty-two pages of bibliography show where they can be obtained.

E. E. C.

FITZRANDOLPH & HAY: Osier-growing and basketry and some rural factories, pp. XII+160. 9 plates. The Rural Industries of England and Wales II. Oxford, Clarendon Press, 1926.

This is one of a number of surveys made by the Agricultural Economic Research Institute, Oxford —an institution similar to which would be invaluable in the tropics. Rural industries provide a fuller life for the rural worker, stem rural depopulation and solve some of the problems of modern industrialism. Hence the possibility of adapting them and developing them becomes increasingly apparent. This volume gives an economic survey of the osier growing, basket making, and the less developed rush, sedge, reed and straw industries, finishing with an account of rural factories. The causes of localisation, the various types of organisation, their effect on agriculture and the prospects of development are fully described in a pleasing and interesting manner. At the time of the survey the outlook for the osier growing and basketry industries was bad: foreign competition and that of more or less permanent substitutes (such as zinc containers and not-returnable empties) was being felt, but it is thought that much might be done by improved organisation and by making known the acknowledged superiority in quality of much of the domestic production.

G. W.

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WHEAT-BREEDING EXPERIMENTS at the Plant Breeding Institute, Cambridge, by Professor Sir R. H. Biffen and F. L. Engeldow. Ministry of Agriculture and Fisheries, London. 2*s*. 6*d*. net.

One of a series intended to give "in the language of everyday life" an account of certain work at the Agricultural Research Institutes of Great Britain, this booklet is a most happy example of popularisation without vulgarisation. In little more than one hundred octavo pages, the aims, methods, and results of an extensive plant-breeding programme are presented, together with the necessary outlines of the underlying principles of genetics and plant-breeding to make the work "readily intelligible to all classes of readers." Even chromosomes are not shirked!

Similar principles are the basis of plant-breeding everywhere, much as crops differ in the specific problems which they present, and although wheat is not a tropical crop, this account may be recommended to any reader who, with no knowledge of the technical aspects of the work, wishes to understand as far as a layman can what scientific investigators are trying to do for agriculture. It might also serve as a model for scientific officers who find it difficult to express their problems and results in popular language without the sacrifice of precision.

E. E. C.

COLONIAL WEST AFRICA. "The African World," London Wall, E.C.2. Price 1s.

Although described by some as a super-advertisement, this little publication contains much that is of value for those concerned directly or indirectly with the territory of West Africa. Following a concise summary of facts, sections are devoted to the various possessions: British, French, Belgian, Portuguese and Spanish, together with the Mandated Territories and the Republic of Liberia.

Historical and geographical notes are succeeded by details of the commerce of the countries and, among other items, of the transport facilities available.

The arrangement is excellent and the type clear, and as a work of reference it should find a place on every book-shelf.

J. K. H.

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THE CANADA YEAR BOOK, 1925. Dominion Bureau of Statistics, Ottawa, Canada. Pages xxxi. 1080 and map.

This is a valuable reference book on all information connected with social and economic conditions of the Dominion of Canada. Chapters are included on the physical characteristics and the constitution and government. Population, trade, commerce and transportation are very fully dealt with; useful historical sketches being appended in many cases. The chapters on labour and finance give all the information that one is likely to require. It is very pleasing to find a section devoted to the sources of official statistics and other information relative to Canada.

G. W.

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THE DOMINIONS AND COLONIAL OFFICES—By Sir George V. Fiddes, G.C.M.G., K.C.B., Permanent Under-Secretary of State for the Colonies, 1916-1921. G. P. Putnam's Sons, Ltd., London. pp. 288. Price 7s. 6d. net.

Sir George Fiddes has dealt with his subject in an admirable manner. In less than 300 pages he describes not only the official machine, but also important and frequently controversial questions affecting the development of Colonies, Protectorates and Dominions. Those familiar with this great organisation will regret that consideration of space prevented the author from giving a fuller treatment of the many topics so deftly dealt with.

C. Y. S.

BOOKS RECEIVED.

WE have to acknowledge the receipt of the following books:—

BOTANY.

Die Zytologie der Blutenpflanzen. Dr. P. N. Schurhoff, pp. 792, Stuttgart, *Ferdinande Enke.*

Guide to the Botanic Gardens, Heneratgoda. K. J. Alex Sylva, pp. 24, Colombo. *H. Ross Cottle, Government Printer.*

Guide to Royal Botanic Gardens, Trinidad. R. O. Williams, pp. 30, Trinidad. *Trinidad and Tobago, Department of Agriculture.*

Potato Varieties. R. N. Salaman, pp. 378. *Cambridge University Press.* 25s. net.

CHEMISTRY AND TECHNOLOGY.

Report of the Food Investigation Board. Department of Scientific and Industrial Research, 1925-26, pp. vi, 80. London. *H.M.S.O.* 2s. 6d. net.

Alcoholometric Tables. Sir Edward Thorpe, pp. 92, London. *Longmans Green & Co.* 4s. 6d.

Practical Physiological Chemistry. S. W. Cole, pp. 479, Cambridge. *H. Heffer & Sons, Ltd.* 16s.

ECONOMICS.

Punjab Manual of Co-operation. Punjab. *Registrar of Co-operative Societies.*

What is Co-operation? C. F. Strickland, pp. ii, 36, Lahore. *Civil and Military Press,* 1926.

A Co-operative Handbook. pp. ii, 118, Lahore. *Government Printing Press.*

Report of the Empire Marketing Board—A Year's Progress. pp. 40, London. *Empire Marketing Board.*

Economic Series. Nos. 1-13, and 15. Ministry of Agriculture and Fisheries. London, *H.M.S.O.*

GENERAL.

Canada Year Book, 1926. pp. 1057, 1 Map, *Dominion Bureau of Statistics.*

Annals of the International Cotton Congress. pp.278, Brasil. *Sociedade Nacional de Agricultura.*

University of Illinois Annual Register, 1926-27. pp. 626. Urbana. *Illinois University.*

Technical Conferences of the East African Dependencies. pp. vi, 338, Nairobi. *East African Standard, Ltd.*

Nigeria Blue Book, 1926. pp. 604, Lagos. *Government Press.*

F. B. I. Year Book, 1927-28. pp. 680, London. *Federation of British Industries.*

U.S. Year Book of Agriculture, 1926. pp. 1298, Washington. *Government Printing Office.*

The Principles of Soil Microbiology. Selman A. Waksman. pp. 598, London. *Bailliere, Tindall & Cox.* 45s. net.

MEDICINE.

Modern Methods in the Diagnosis and Treatment of Renal Disease. Hugh McLean, pp. 136. London, *Constable,* 12s. net.

ZOOLOGY AND ENTOMOLOGY.

Guide to the Crustacea. pp. 82, London. *British Museum.*

Insects of Samoa. Part 2, Fasc. 1, pp. 45, Part 3, Fasc. 1, pp. 64. Fasc. 2, pp. 65-116. Part 7, Fasc. 1, pp. 44, London. *British Museum.*

Index Animalium, Part xii. London. *British Museum.*

Catalogue of the Type specimens of Lepidoptera Rhopalocera in the British Museum, pp. 128. London, *British Museum.*

Protozoology. C. M. Wenyon, 2 vols, London. *Bailliere, Tindall & Cox,* 84s. net.

COLLEGE NEWS.

Professor C. Y. Shephard represented the College at the meeting of the British Association at Leeds this year.

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Mr. Harold L. Lyon, a mycologist from the Honolulu Sugar Planters' Association, visited the College recently. He is paying a short visit to Trinidad.

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Sir J. Farmer was one of the representatives of the College at the Imperial Agricultural Research Conference of last month. Mr. C. Y. Shephard, Professor of Economics, also acted as a representative.

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Mr. Holman Williams who holds the diploma in tropical agriculture of the Imperial College, has recently written an interesting article for the *Revue Agricole; organe du service d'agriculture de la Guadeloupe et Dependances*, one of the sections of which gives a concise account of the College and its work.

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His Excellency Sir Cecil H. Rodwell, K.C.M.G., Governor of British Guiana, accompanied by Colonel H. Johnston and the Hon. W. E. F. Jackson, C.M.G., Acting Governor of Trinidad and Tobago, paid a visit to the College on 2nd October, and lunched with the Principal. An opportunity was taken of making a thorough inspection of the new Milner Hostel buildings and of the arrangements made for the accommodation of the students generally. Matters of agricultural interest affecting British Guiana were discussed.

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Professor Ballou left Trinidad 17th September on a visit to St. Vincent in connection with his duties as Commissioner of Agriculture. At a meeting of the St. Vincent Chamber of Commerce, Professor Ballou spoke on the present critical situation, which has come about from an over-production in the West Indian Sea Island Cotton Industry, and the need for a reduction in production during the next two or three years. The other crops which may be grown in that island by estate and peasant cultivators in the place of cotton were discussed. Professor Ballou returned to Trinidad on 23rd September.

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Mr. H. C. Taylor, an entomologist of the Government Agricultural Department, Fiji, who has been secured for work with the Fiji Coconut Planters Association has arrived at the College for special research work in connection with the breeding of certain coccinellid beetles that are parasites on the coconut scale (*Aspidiutus destructor*). The College is placing the resources of the Entomological Laboratories at his disposal and is offering him every facility. It is understood that an attempt will be made to introduce the useful parasites on the coconut scale into the colony of Fiji, and the work will possibly necessitate a stay of about four months duration by Mr. Taylor at the College.

The College session for the year 1927-28 commenced on the 10th October. The following Students are taking the Diploma Course :—

1st Year :—Messrs. A. F. Nichols and C. A. S. Hynam (Barbados); Messrs. J. F. Williams and E. S. A. Chin (British Guiana); Messrs. C. K. Robinson and J. E. de la Bastide (Trinidad); and Mr. J. H. C. Grell (Nevis).

2nd Year :—Mr. A. F. W. Sheffield (England); Mr. R. S. Hanomansingh (British Guiana); and Mr. A. L. Grogan (Barbados).

3rd Year :—Mr. M. S. Aspiazu (Ecuador); Mr. A. C. Palmer (St. Lucia); Messrs. L. S. Birkett and G. E. L. Spencer (Barbados); and Mr. F. McG. Bain (Trinidad).

4th Year :—Mr. J. A. MacDonald (Antigua). For Sugar Technology.

The Colonial Office Students are as follows :—

Mr. O. J. Voelcker. (Trip. pt. I Camb., Dip. Agric., pt. I.)
Mr. H. P. Smart, B.Sc. (Transvaal).
Mr. A. H. Savile. (Dip. Wye).
Mr. J. D. Broatch, B.Sc. (Edin.).
Mr. N. V. Rounce. (Dip. Wye).
Mr. J. H. Palmer. (Trip. pt. I Camb., Dip. Agric., pt. I).
Mr. J. L. Greig, B.Sc., Agric., B.Sc. in Pure Science, Aberdeen.
Mr. G. N. K. Turnbull. (Dip. Glasgow.)
Mr. E. W. Leach, B.Sc. (Reading).
Mr. J. E. Bruce. (Dip. Glasgow.)
Mr. C. L. Skidmore, B.Sc. (Wye).
Mr. G. Cowan. (Dip. Glasgow.)
Mr. A. K. Briant. (Trip. pt. I Camb., Dip. Agric., pt. I and II.)
Mr. F. E. Buckley (A.R.C.S. 2nd class).
Mr. E. B. Martyn (2nd class final hnrs. School of Botany, Oxford).
Mr. C. B. Taylor, B.Sc. (2nd class hnrs. in Agric., and Bacteriology, Leeds).

The Empire Cotton Growing Corporation Students are as follows :—

Mr. W. Allan, B.Sc. (Ord. Glasgow).
Mr. A. C. Bebbington, B.Sc. (Bot. and Chem. Leeds, 2nd class hnrs. degree Bot.).
Mr. H. R. Hosking, B.Sc. (hnrs. Lond., A.R.C.S. pure Bot.).
Mr. H. Hutchinson, B.Sc. (1st class hnrs., Durham, Chem.).
Mr. A. H. Lewis, B.Sc. (Lond. hnrs. Chem.).
Mr. R. M. Maynard, B.Sc. (Birmingham, Pass (1st class dist. in Chem.), Bio-Chem. and Bot.).

Mr. H. A. Pieris, B.A. (Camb.), of Ceylon, is taking a special course.

Mr. M. Afzal, B.Sc., Agric. (India) and Mr. S. J. F. Dias (Ceylon) returned to take a 2nd Year's special course.

Mr. F. S. Thomson, Deputy Manager of the Berbice Sugar estates of Messrs. Davson & Co. in British Guiana, is taking a short course.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—During the early part of September the market showed a firm tendency, but the Cuban situation dominated and kept it in a nervous and unsettled condition. Our latest cabled quotations (13th October) are: Foreign 96° *c.i.f.*, 12*s*. Preferential 15*s*. 6*d*. Yellow Crystals, landed duty paid 29*s*. to 33*s*. per cwt. Board of Trade figures for July-August give Home Consumption 1,047,285 tons against 1,111,739 tons in 1926, stock in bond, 31st August 246,700 tons against 363,900 tons in 1926.

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COCOA.—Up to the end of September there was no important improvement to note, business on spot has become extremely restricted. Nominal spot quotations 20th September were: Trinidad 80*s*. to 84*s*.; Fine Grenada 77*s*. to 79*s*.; Fine Jamaica 75*s*. to 76*s*.; Guayaquil 80*s*. to 100*s*.; Fermented Accra 67*s*. to 72*s*. Quotations (13th October) were: Trinidad L.L.T. 80*s*. to 84*s*. and Grenada L.L.T. 78*s*. to 79*s*. per cwt.

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COTTON.—At the end of September prices showed a severe decline. Bullish confidence was already very shaky when the United States Bureau of Economics issued a statement to the effect that accepting the Agricultural Bureau probable crop of 12,692,000 bales, and with a carry-over of 7,800,000 bales, all ex-linters, an adequate supply was shown, and that lower prices were indicated for the next two or three months. This caused a semi-panic in New York, and longs liquidated extensively, with consequent sharp decline. It seems likely that the decline has about gone far enough.

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COFFEE.—Bold and coloury coffee has been bringing full rates but the less desirable descriptions have been slow of sale. At the end of September fine Costa Rica touched 191*s*. per cwt.; Blue Mountain Jamaica prices were maintained; the Brazilian market was somewhat dearer, Superior Santos being quoted at 80*s*. to 81*s*., cost and freight.

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TEA.—The average continued to show a good all-round market, and especially an appreciation of fine Empire tea. The stocks are about 10,000,000 lb. lower than a year ago when they were 10,000,000 lb. lower than in 1925.

COPRA.—The market has been firmer, West Indian has risen from £26 17*s*. 6*d*. in mid-September to £27 2*s*. 6*d*. on 13th October. England is demanding higher grades.

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RUBBER.—Current restriction quarter shows a mean price of 17*d*., but in spot (13th October) 1*s*. 3⅝*d*. was all that could be relied on.

CO-OPERATION.

ADDRESS BY SIR HORACE PLUNKETT.

THE Right Hon. Sir Horace Plunkett, in his presidential address at the annual meeting of the Irish Agricultural Organisation Society, held recently in the Mansion House, Dublin, gave a comprehensive review of the history of the society. Farmers were faced with the difficulty of buying everything they required in the industry at retail price and selling everything they produced at wholesale price. They had endeavoured to change this by organising the industry on co-operative and not joint stock principles. Considerable difficulty was encountered at the outset and Sir Horace recalled that it was only after holding fifty meetings that he secured his first success. The I.A.O.S., a novel venture, was formed in 1894 and formed a model which later was extensively copied. It was laid down as a fundamental principle that State assistance to the agricultural industry should be administered so as to supplement organised self-help, and in nowise to be a substitute for it. He recognised the fundamental necessity of the services performed by middlemen, but urged that every body of farmers must be so well organised at the producing end that if their produce were not distributed efficiently and economically they could take over the business themselves. In referring to credit facilities he quoted a statement to the effect that existing bank arrangements gave to farmers all the credit for which they had security. In commenting on this statement he emphasised that there were two kinds of security of which the ordinary banks took no cognisance because they did not understand it, but which were essential to a properly organised agricultural community. These bases of security were, firstly, the knowledge that the Co-operative Society had as to the character and business capacity of the members, and secondly, the knowledge that they had, and the judgment that the Governing Body had, of the purpose for which a loan was asked. The bank without that knowledge, would give a loan for 60 or 90 days; but the credit society would lend the money for as long as it was wanted, and would not ask for its repayment before the farmer could pay it back out of the profits that he had made on the transaction for which the loan had been granted.

C. Y. S.